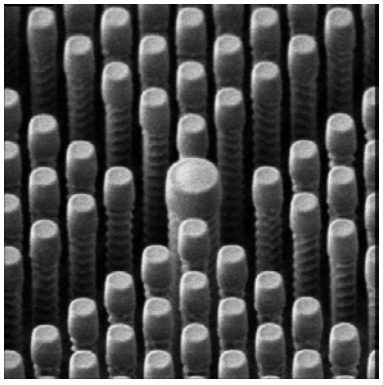
1.55 μm Pure Photonic Crystal Waveguiding in Two Dimensions

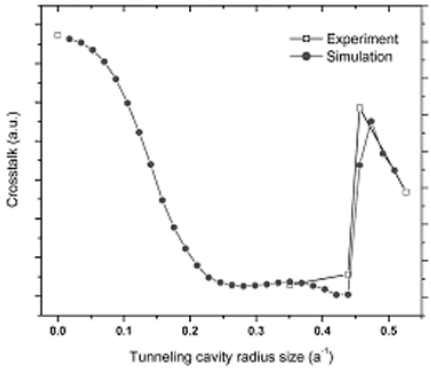
Selin H. G. Teo, J. Singh, M. B. Yu, and A. Q. Liu
School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore 639798

We report experiments of optical guiding in air at 1.55 μm wavelength in two-dimensional (2D) photonic crystal (PhC) waveguides. The deeply etched photonic crystal structure with crossing geometry and C_{4v}-symmetry tunneling cavities[1] of Fig. 1a was realized by deep reactive Ion etching for record sidewall scallop depth and aspect-ratio[1]. The radiation was guided only by effect of the 2D PhC, in the absence of other waveguiding mechanisms such as index guiding or reflecting planes etc. First principle simulation results were verified by experiment of both reflection and transmission measurements. The results obtained corresponded well with theoretical simulation results by finite-difference-time-domain method (see Fig. 1b), which indicate a critical value for the depth of etching required. At the same time, discrepancy between symmetry restricted and non-restricted orthogonal waveguide modes transmission measurements also revealed relation of cavity property to extend of radiation loss for such 2D PhC waveguides.

[1] Steven G. Johnson, Christina Manolatou, Shanhui Fan, Pierre R. Villeneuve, J. D. Joannopoulos, and H. A. Haus, *Opt. Lett*. **23**, 1855 (1998).
[2] Selin H. G. Teo, A. Q. Liu, J. Singh, M. B. Yu, *J. Vac. Sci. Technol. B*, 22, 2640 (2004).



(a)



(b)

Figure 1 (a) Scanning electron micrograph of PhC waveguides (b) experiment measurement (unfilled-symbols) and FDTD simulation results (filled-symbols) for crosstalk.